3. ENVIRONMENTAL PROGRAMS

3.1 SUMMARY

Environmental programs at DOE/PORTS include Environmental Restoration, Waste Management, Waste Minimization, Pollution Prevention, Training, Information Exchanges, and Public Awareness.

3.2 ENVIRONMENTAL RESTORATION PROGRAM

DOE established the Environmental Restoration Program in 1989 to identify and correct site contamination areas as quickly and cost-effectively as possible. The Environmental Restoration Program was granted an initial budget of $13.8 million. The 1999 Environmental Restoration Program expenditures were $21 million.

The Environmental Restoration Program addresses inactive sites through remedial action and deals with active facilities through eventual decontamination and decommissioning. Options for correcting or mitigating the contaminated sites and facilities include removal, containment, and treatment of contaminants. Because PORTS is a large facility, it is divided into four quadrants (Quadrant I, II, III, and IV) to facilitate the cleanup process.

The Environmental Restoration Program was established to fulfill the cleanup requirements of the Ohio Consent Decree and U.S. EPA Administrative Consent Order, both issued in 1989. As required by these enforcement actions, DOE/PORTS Environmental Restoration Program activities are conducted in accordance with the RCRA corrective action process, which consists of the following:

- *Description of current conditions* – to provide knowledge of the groundwater, surface water, soil, and air.
- *RCRA facility assessment* – to identify releases of contaminants and determine the need for further investigation.
- *RCRA facility investigation* – to determine the nature and extent of any contamination.
- *Cleanup alternatives study/corrective measures study* – to evaluate and select a remediation alternative.
- *Corrective measures implementation* – to implement the selected remediation measure.
- *Interim remedial measures* – to implement quick remediation or mitigation measures prior to permanent action.

DOE/PORTS has completed the description of current conditions, RCRA facility assessment, and RCRA facility investigation. No interim remedial measures were undertaken in 1999. Cleanup alternatives study/corrective measures study activities, corrective measures implementations, and technology applications are described in the following sections.

3.2.1 Cleanup Alternatives Study/Corrective Measures Study

As required by the Consent Decree and the Administrative Consent Order, the cleanup alternatives studies/corrective measures studies identify the solid waste management units and explore the remedial alternatives within Quadrants I through IV. Following the approval of the final cleanup alternative studies/corrective measure studies, Ohio EPA selects the remedial alternatives that will undergo further review for determining the final remedial actions. Upon concurrence from the U.S. EPA and completion of the public review and comment period, the U.S. EPA and Ohio EPA select the final remedial actions for each quadrant. Ohio EPA issues a decision document to notify DOE/PORTS of the final remedial actions chosen for the site. DOE/PORTS is required to submit a corrective measures implementation plan that details the implementation of the final remedial actions listed in the decision document. Following the approval of the corrective measures implementation by the Ohio EPA, remedial action can begin.

The cleanup alternative studies/corrective measure studies for Quadrants III and IV were approved by Ohio EPA in 1998. The *Quadrant I Cleanup Alternative Study/Corrective Measures Study* was submitted to Ohio EPA on May 28, 1999. Based on comments received from both the U.S. EPA and Ohio EPA, the *Quadrant I Cleanup Alternative Study/Corrective Measures Study* was revised and resubmitted to Ohio EPA on December 28, 1999. Development of the *Quadrant II Cleanup Alternative Study/Corrective Measures Study* continued in 1999.

In 1999, Ohio EPA issued the decision document for Quadrant III and for the X-734 Landfill Area (part of Quadrant IV). A summary of these corrective measures is discussed in the next section. DOE received the decision document for Quadrant IV in 2000.

3.2.2 Corrective Measures Implementation

3.2.2.1 X-740 Waste Oil Handling Facility

The Quadrant III decision document identified only one solid waste management unit that required remedial action: the X-740 Waste Oil Handling Facility (groundwater only). During its period of operation, from 1982 to 1992, the facility was used as a drum-staging area of non-radionuclide contaminated waste oils and solvents generated by various plant site activities. This facility underwent RCRA closure in 1993 including decontamination of the floor and walls of the facility and removal of a tank/sump and surrounding contaminated soil. The remaining groundwater contamination (consisting mainly of trichloroethylene) at this facility is the basis for the remedial action recommended by Ohio EPA in its decision document.

Ohio EPA's preferred cleanup alternative involves institutional controls and the use of *in situ* (in place) phytoremediation for the X-740 groundwater plume. Phytoremediation is considered an emerging technology that uses plants to remove, degrade, or contain contaminants in soil and groundwater. Although phytoremediation is an emerging technology, it has been shown to remediate trichloroethylene at several Department of Defense and Superfund Sites.

A total of 765 one-year-old hybrid poplar trees were planted in rows about 10 feet apart over a 2.6-acre area above the X-740 groundwater plume. Planting was completed ahead of schedule on May 27, 1999. The poplar trees are expected to have a mature root system within 2 years. Mature trees can consume more than 3,000 gallons of groundwater per day per acre. Organic compounds are expected to be removed from the groundwater and captured in the trees' root systems. The organic compounds do not accumulate in the trees. As shown in Fig. 3.1, volatile organic compounds are degraded by ultraviolet light as they are transpired along with the water vapor through the leaves of the trees.

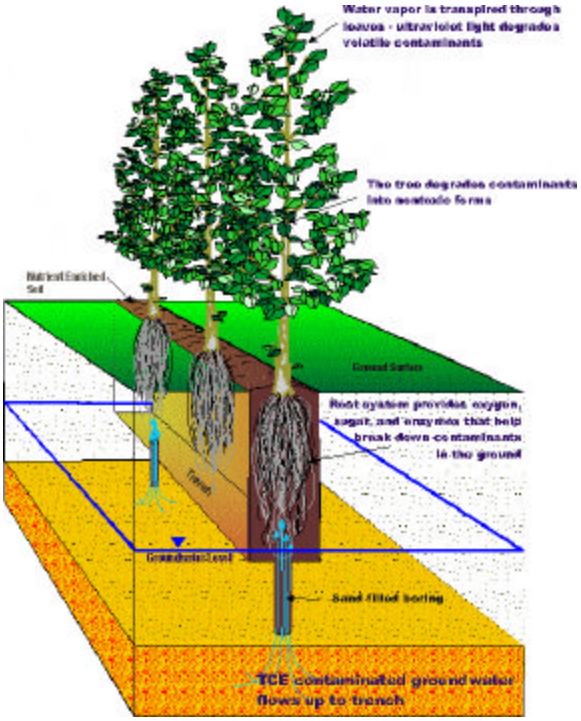

Fig. 3.1. Phytoremediation system.

Local experts offered assistance in tree species selection. Three different species of trees were chosen in order to provide greater resistance to various diseases. A multi-species approach ensures an increased success rate for the plantation. Even if one entire species were destroyed, the remaining two-thirds could continue to function.

The Ohio State University Department of Agriculture provided assistance with the tree planting plan. PORTS plans to partner with local forestry resource specialists and utilize their expertise to monitor and care for the trees at no cost after they are planted. In return, the trees will be donated to an area firm when they are mature and remediation is complete.

PORTS will realize an estimated cost savings of more than $31 million by implementing this phytoremediation technology rather than a standard groundwater pump-and-treat facility. It cost $500,000 to plant the trees for this project, whereas a treatment facility would cost $2 million to build and $1 million a year for 30 years to operate.

3.2.2.2 X-734 Landfill Area

Ohio EPA issued a decision document for the X-734 Landfill Area in April 1999. This area consists of the X-734 Old Sanitary Landfill, the X-734A Construction Spoils Landfill, and the X-734B Construction Spoils Landfill.

The X-734 Old Sanitary Landfill has a total of approximately 3.8 acres. Waste known to be disposed in this area includes trash and garbage, construction spoils, and waste containing metals. The X-734A Construction Spoils Landfill has a total area of approximately 3.5 acres and is adjacent to the southern boundary of X-734 Old Sanitary Landfill. In March 1985 empty drums were disposed in the spoils area; the practice was subsequently discontinued. Waste disposed of at X-734A included construction spoils, trees, railroad ties, broken concrete, stumps, roots, brush, and other wastes from clearing and grubbing operations.

The X-734B Construction Spoils Landfill is located south of X-734A and has a surface area of approximately 4.6 acres. A road and buffer zone separate the northern boundary of X-734B from X-734A. X-734B reportedly received the same type of waste as X-734A: construction spoils, trees, railroad ties, broken concrete, stumps, roots, brush, and other wastes from clearing and grubbing operations.

Ohio EPA's preferred alternative for the X-734 Landfill Area is a multi-media cap at X-734/ X-734A, a soil cap at X-734B, and phytoremediation. This project has been initiated in two phases. Phase I consists of the installation of an 18-inch soil cap on 4.6 acres of the southern portion of the

landfill (X-734B). The soil cap is covered with a 6-inch vegetative layer and planted with grass seed. Phase II consists of the installation of a multi-media cap on the northern portion of the landfill (X-734/X-734A). The phytoremediation portion of the project was designed to be installed downgradient of X-734B to capture and remediate any groundwater that could potentially migrate from beneath the landfill.

Construction of the soil cap at X-734B (Phase I) began on August 16, 1999, and was completed on September 24, 1999. The phytoremediation portion of this project was conducted in May 1999 along with the X-740 phytoremediation discussed in the previous section (40 trees were installed in May 1999). Construction of the multi-media cap at X-734/X-734A (Phase II) was initiated on November 8, 1999. On December 7, 1999, the Project Team decided to suspend construction of the multi-media cap for the winter. The project was completed in 2000.

3.2.3 Additional Cleanup Alternatives Study/Corrective Measures Study Activities

3.2.3.1 Quadrant III and Quadrant IV confirmatory sampling

In an effort to determine final disposition of solid waste management units within Quadrant III and Quadrant IV, DOE met with Ohio EPA and agreed to perform additional confirmatory sampling in these quadrants. A confirmatory sampling strategy was submitted to Ohio EPA on November 11, 1999. On November 22, 1999, Ohio EPA accepted the sampling plan and requested a schedule for performing this sampling. Sampling was completed by the end of December 1999, with the results available in early February 2000.

3.2.4 Technology Applications

The DOE/PORTS Technology Applications Program was established in 1993 to facilitate the introduction of innovative or experimental environmental technology into the DOE/PORTS Environmental Restoration Program. The primary function of the technology program is to identify, evaluate, and test/demonstrate innovative advancements in environmental characterization and cleanup. The goal is to incorporate the most practical, cost-effective cleanup approaches as they are evolving for full-scale application at the plant. By combining conventional research and development with cleanup efforts, technology demonstrations enable the site to solve real problems using innovative methods. The Technology Applications Program utilizes a team of DOE contractors, national laboratory scientists, university researchers, private industries, site engineers, and technical staff.

3.2.4.1 X-701B *in situ c*hemical oxidation

Oxidation is a type of chemical reaction. *In situ* (in place) chemical oxidation is used to remediate volatile organic compounds such as trichloroethene in groundwater. With this technique, chemical oxidants are injected into the ground, a chemical reaction takes place, and the trichloroethene is changed into nontoxic chemical compounds. Laboratory experiments have demonstrated that potassium permanganate, sodium permanganate, and hydrogen peroxide can effectively oxidize trichloroethene.

The X-701B Holding Pond area was chosen for this technology demonstration because of the existing horizontal and vertical groundwater wells and the extensive site characterization data for the area. In 1998, groundwater was extracted from one horizontal well, pumped to an existing groundwater treatment facility, mixed with potassium permanganate, and reinjected into a parallel horizontal well approximately 90 ft away. The results of this test indicated that *in situ* chemical oxidation through recirculation effectively oxidized trichloroethene in groundwater in the area affected by the wells. Where the oxidant was found, trichloroethene was no longer detectable.

In 1999, another demonstration was conducted using sodium permanganate injected through vertical wells. This demonstration was conducted from August 9, 1999, through October 3, 1999. The system was shut down because the sodium permanganate was moving from below ground, where it had been injected, to the ground surface. Following a series of tests to identify and correct the problem, the demonstration was restarted in 2000.

3.2.4.2 X-749/X-120 vacuum enhanced recovery wells

This technology application uses a vacuum to increase the amount of water that can be pumped from a groundwater recovery well. Groundwater wells are often used to remove contaminated groundwater from an aquifer. The amount of water that can be removed from a well depends on the soil beneath the ground surface. If the groundwater is an area made up primarily of sand, which is a large soil particle, water can be easily removed from the ground. If the groundwater is in an area that is primarily clay, which is a small soil particle, it is much more difficult to remove groundwater. This type of soil is called a low permeability soil. Vacuum enhanced recovery wells are designed to increase the flow of water from a groundwater recovery well that is in an area made up of smaller soil particles.

In addition to increasing the amount of water recovered from a well, the movement of air due to the vacuum also causes chemicals in the groundwater to volatilize, or move from the soil or water into the air, which further aids the removal of contaminants.

The X-749/X-120 groundwater plume was the selected site for this demonstration because this groundwater plume contains volatile organic compounds such as trichloroethene and trichloroethane, and this area also has low permeability soils. These conditions met the location requirements for the primary test objective, which was to demonstrate the effectiveness of vacuum enhanced recovery technology in reducing chlorinated volatile organic compounds in low permeability geologic formations. The secondary objective of the project was to collect information for the design of a full-scale implementation of the technology.

Field work for this project began in August 1998 and was completed in December 1998. In total, five vacuum-enhanced extraction wells were installed and tested during the project. The final report was submitted to the Ohio EPA on March 10, 1999. Results of this pilot project have been incorporated for consideration as alternatives in the Quadrant I and Quadrant II cleanup alternatives study/corrective measures study reports.

3.2.4.3 5-Unit Area (Quadrant I Groundwater Investigative Area) oxidant injection

The 5-Unit Area Oxidant Injection Pilot Project used an *in situ* chemical oxidant injection and recirculation process, similar to that described for the X-701B *In Situ* Chemical Oxidation Project discussed previously in this chapter. The project at this area involves recirculation of groundwater through four pumping wells located at fixed distances from a central injection well. The oxidant permanganate, as either potassium permanganate or sodium permanganate, is added to extracted groundwater that is then reinjected into the aquifer.

The Ohio EPA and DOE/PORTS agreed to conduct a site-specific pilot project to provide additional data to facilitate the completion of the corrective measures study alternative development process for the remediation of the 5-Unit Area (Quadrant I Groundwater Investigative Area). A second objective of the pilot project was to obtain data to determine the amount of contaminants removed by the project.

The treatment system was used in two locations in 1999. The final report on this treatment technology was submitted to Ohio EPA on September 30, 1999, indicating the technology is an acceptable option for groundwater remediation in this area at PORTS.

3.2.4.4 X-701B underground steam stripping and hydrous pyrolysis/oxidation

The X-701B Underground Steam Stripping and Hydrous Pyrolysis/Oxidation Project implements a process called dynamic underground steam stripping to remove volatile organic compounds from groundwater. The process removes volatile organic compounds by injecting steam underground through multiple wells, thus heating the area to above the contaminants' boiling points. This heating vaporizes the compounds so that they can then be removed by vacuum extraction wells. An additional process called hydrous pyrolysis/oxidation destroys contaminants not removed by the extraction wells.

Installation of the wells and monitoring equipment was completed in December 1998. Equipment mobilization and set-up was completed on January 9, 1999. On January 28, 1999, the vacuum system was placed in service; steam injection began the next day. The system operated until June 12, 1999, when pumping and vapor extraction from the well field were terminated. Approximately 68 gallons of trichloroethene (or about 80% of the contaminant) were removed from the treatment area, confirming the technology as a viable alternative for use at PORTS.

3.3 WASTE MANAGEMENT PROGRAM

The DOE/PORTS Waste Management Program directs the safe storage, treatment, and disposal of waste generated by past and present operations and from current Environmental Restoration projects. DOE/ PORTS also stores USEC-generated waste in the RCRA Part B permitted storage areas. Waste managed under the program is divided into the following six categories, which are defined below:

- *Low-level radioactive waste (LLW)* – radioactive waste not classified as high level or transuranic and that does not contain any components regulated by RCRA or the Toxic Substances Control Act.

- *Hazardous (RCRA) waste* – waste that contains one or more of the wastes listed under RCRA or that exhibits one or more of the four RCRA hazardous characteristics: ignitability, corrosivity, reactivity, and toxicity.

- *RCRA/LLW mixed waste* – waste containing both hazardous and radioactive components. The waste is subject to RCRA, which governs the hazardous components, and to additional regulations that govern the radioactive components.

- *PCB wastes* – waste containing PCBs, a class of synthetic organic chemicals. Under Toxic Substances Control Act regulations, PCB manufacturing was prohibited after 1978. However, continued use of PCBs is allowed, provided that the use does not pose a risk to human health or the environment. Disposal of all PCB materials is regulated under the Toxic Substances Control Act.

- *PCB/LLW mixed waste* – waste containing both PCB and radioactive components. The waste is subject to the Toxic Substances Control Act that governs PCB components, and to additional regulations that govern radioactive components.

- *Industrial sanitary waste* – waste generated by commercial operations, such as office waste.

During 1999, approximately 4.6 million pounds of waste from PORTS were recycled, treated, or disposed (Table 3.1). Future waste management projects include the shipment for disposal of low-level radioactive waste and mixed waste, and the treatment of mixed and PCB/mixed waste at off-site commercial facilities.

Table 3.1. Waste Management Program treatment, disposal, and recycling accomplishments for 1999

Waste stream	Quantity	Treated, disposed, or recycled	Treatment, disposal, or recycling facility
Waste streams characterized	21 waste streams (2,120 drums)	Not applicable	Not applicable
X-701B Interceptor Trench soils	560 drums / 919,245 lbs	Disposed	Envirocare
X-701B sludge	384 B-25 boxes / 1,899,535 lbs	Disposed	Envirocare
X-705A/B soils	214 B-25 boxes / 1,260,009 lbs	Disposed	Envirocare
RCRA/PCB/LLW liquids	143 containers / 27,830 lbs	Treated	TSCA Incinerator
Hydrogen cyanide cylinder	One 3-liter cylinder / 20 lbs	Treated and disposed	SET Environmental
Aerosol cans liquids	Two drums / 642 lbs	Treated and disposed	Safety-Kleen
Waste water	175,621 lbs	Treated	Onsite Treatment Facilities
PCB mineral oil	29 drums / 12,250 lbs	Treated and disposed	S. D. Meyers
Radioactive empty drums	4,038 drums / 254,500 lbs	Recycled	U.S. Ecology
Fluorescent light bulbs	10,611 lbs	Recycled	Superior Special Services, Inc.
NiCad batteries	8,149 lbs	Recycled	InMetCo
Aluminum cans	1,578 lbs	Recycled	Star, Inc.
Cardboard	7,045 lbs	Recycled	Star, Inc.
Mixed office paper	36,980 lbs	Recycled	Star, Inc.

Waste management requirements are varied and are sometimes complex because of the variety of waste streams generated by DOE/PORTS activities. DOE Orders, Ohio EPA regulations, and U.S. EPA regulations must be satisfied to demonstrate compliance for waste management activities. Additional policies have been implemented for management of radioactive, hazardous, and mixed wastes. These policies include the following:

- minimizing waste generation;
- characterizing and certifying wastes before they are stored, processed, treated, or disposed;
- pursuing volume reduction (such as blending and bulking) as well as on-site storage in preparation for safe and compliant final treatment and/or disposal; and
- recycling.

3.4 WASTE MINIMIZATION AND POLLUTION PREVENTION PROGRAM

DOE/PORTS has combined its waste minimization and pollution prevention efforts to consolidate related activities. The objectives of the DOE/PORTS Waste Minimization and Pollution Prevention Program include the following:

- fostering a philosophy to conserve resources and create a minimum of waste and pollution;
- promoting the use of nonhazardous materials in DOE/PORTS operations to minimize potential risks to human health and the environment;
- reducing or eliminating the generation of wastes through material substitution, product reformulation, process modification, improved housekeeping, and on-site recycling; and
- complying with federal and state regulations and DOE policies and requirements for waste minimization.

The DOE/PORTS Waste Minimization and Pollution Prevention Program continues activities to achieve the waste minimization objectives. Typical projects include the following:

- maintaining a comprehensive waste tracking and reporting system;
- evaluating DOE/PORTS processes and activities to identify waste minimization opportunities;
- maintaining an effective DOE/PORTS waste minimization training program;
- maintaining a waste minimization and pollution prevention awareness promotional campaign; and
- providing a waste minimization and pollution prevention information exchange network.

The Pollution Prevention Awareness Program consists of (1) pollution prevention awareness through Earth Day events, newsletters, bulletins, and memoranda; (2) awards, recognition for employees, and performance indicators; (3) information exchange; and (4) training. Other recognized pollution prevention measures are the *Best Management Practices Plan* and the *Portsmouth Spill Prevention, Control, and Countermeasures Plan.*

Highlights of the Waste Minimization and Pollution Prevention Program in 1999 include the following:

- reused excess computer equipment by donating it to public schools through the Southern Ohio Diversification Initiative;
- sent empty drums contaminated with radioactivity to a facility that will reuse them instead of contaminating clean drums;
- participated in the Ohio Governor's Earth Day celebration at the state capital;
- provided sixth-grade students with lessons on using discarded materials for new purposes at the Environmental Fair;
- sent over 8,000 pounds of spent NiCad batteries to a recycling facility;
- recycled more than 44,000 pounds of sanitary waste including office paper, corrugated cardboard, and aluminum cans;

- recycled more than 5,700 oversized pallets through the Southern Ohio Diversification Initiative;
- sent 250 pounds of excess weapons to the Lawrence Livermore National Laboratory;
- started a project to reduce the inventory of mixed waste through releasing some lead liners and ductwork from radiological controls to be recycled as scrap metal.

Activities planned for 2000 include initiating a comprehensive training program for Environmental Restoration activities to support the goals established in Executive Order 13101, continuing the scrap metal recycling program, implementing programs to prevent managing spent batteries and light bulbs as waste, and conducting a Pollution Prevention Opportunity Assessment on low-volatile organic compound floor coverings for the RCRA storage area.

3.5 ENVIRONMENTAL TRAINING PROGRAM

DOE/PORTS provides environmental training to increase employee awareness of environmental activities and to enhance the knowledge and qualifications of personnel performing tasks associated with environmental assessment, planning, and restoration. The program includes on- and off-site classroom instruction, on-the-job training, seminars, and specialized workshops and courses. Environmental training conducted or prepared by DOE/PORTS includes hazardous waste training required by RCRA and numerous Occupational Safety and Health Administration training requirements.

3.6 INFORMATION EXCHANGE PROGRAM

To improve and update its environmental monitoring and research programs, DOE/PORTS exchanges information within the site and with other DOE facilities and other sources of information. DOE/PORTS representatives attend both DOE-sponsored and independent technical information exchange workshops, such as the annual DOE Model Conference, quarterly multi-plant team meetings, and professional conferences.

3.7 PUBLIC AWARENESS PROGRAM

A comprehensive community relations and public participation program has been in place since early 1990. The purpose of the program is to foster a spirit of openness and credibility between PORTS officials and local citizens, elected officials, business, media, and various segments of the public. The program also provides the public with opportunities to become involved in the decisions affecting environmental issues at the plant.

DOE/PORTS opened a public Environmental Information Center in February 1993 to provide public access to all documents used to make decisions on remedial actions being taken at the plant. The information center is on the plant site in a modular unit outside the E-Vehicle portal. The mailing address for the Information Center is U.S. DOE Environmental Information Center, P.O. Box 693, Piketon, Ohio 45661. The street address is 3930 U.S. Route 23 South, Perimeter Road West, Piketon, Ohio 45661. Hours for the Information Center are 9 a.m. to 12 p.m. Monday and Tuesday, 12 p.m. to 4 p.m. Wednesday and Thursday, or by appointment (740-289-3317).

A group of approximately 45 key stakeholders, composed of elected officials, community leaders, environ-mentalists, and other individuals who have expressed an interest in the Environmental

Restoration and Waste Management Programs, is targeted for information and input on current activities and actions under consideration at the plant. Semiannual public update meetings and public workshops on specific topics are also held to keep the public informed and to receive their comments and questions. Periodically, fact sheets about major projects are written for the public. Semiannual environmental bulletins are printed and distributed to more than 4,000 recipients, including those on the community relations mailing list, neighbors within 2 miles of the plant, and all plant employees and retirees.

Points of contact have been established for the public to obtain information or direct questions regarding the Environmental Restoration and Waste Management Programs. The DOE Site Office may be contacted at 740-897-2001. The Bechtel Jacobs Company Public Affairs Manager (740-897-2336) also provides information on the programs.